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SciVerse ScienceDirect

Procedia Social and Behavioral Sciences 23 (2011) 189–190

Procedia Social and Behavioral Sciences

Academy of Aphasia 2011

Hemispheric Asymmetry Reduction in Older Adults during Access to Semantic Memory

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Background

Research findings regarding access to semantic memory in older adults are inconsistent, showing in some cases even equivalent levels of performance as young adults. While reduction in the function of the brain is a normal outcome of aging, the equivalent levels of performance may be attributed to the possibility that compensatory mechanisms occur in older individuals. Neuroimaging evidence has suggested that a pattern of neurofunctional reorganization, the Hemispheric Asymmetry Reduction in OLDer Adults (HAROLD, Cabeza et al., 1997), may occur in high-performing older individuals: those with higher levels of education. This phenomenon corresponds to a bilateral pattern of activation associated with a given task that occurs in older individuals than in young adults, who show unilateral activation for the same task. Since pattern of access to emotional words (as part of the semantic system) in young individuals has been shown to be mostly unilateral, the present study was designed to investigate the possibility that a bilateral pattern of access would occur in high-performing older individuals over the course of access to emotional words.

Methods

Twenty-eight older and 28 young adults, right-handed, native English speakers who were matched in years of formal education participated in the study.

The study was carried out by employing the affective priming paradigm along with an evaluation task. Access was tracked at different times over the course of processing. A set of 144 congruent pairs ("crime-horror") and incongruent pairs ("miracle-betray") were presented in three blocks, under three different Stimulus Onset Asynchrony (SOA) of 150, 300, and 750 ms, to the left visual field (LVF) or right visual field (RVF) and reaction times and accuracy of the evaluation of the target were measured.

Results

The design was a 2 x 2 x 3 x 2 mixed ANOVA with congruency (congruent, incongruent), visual field (RVF-RVF, LVF-LVF), and SOA (150, 300, and 750 ms) as within-participant and age (older, young) as between-participant variables. The results showed the same level of accuracy in older and young participants. However, older adults responded to the stimuli slower than young adults. While, in young adults, priming appeared to be unilateral in the RVF at 150-ms SOA and in the LVF at 750-ms SOA, in older participants priming occurred bilateral whenever it was present: at the 300-ms and 750-ms SOAs. No priming was detected at 150-ms SOA in older and at 300-ms SOA in young adults.

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doi:10.1016/j.sbspro.2011.09.232

Discussion

In high performing older adults, both hemispheres contributed to maintain the same level of accuracy that young adults reached by recruiting only one hemisphere. This outcome seems to be in favor of the compensation view of the HAROLD phenomenon, which suggests increased bilaterality helps older adults counteract age-related neurocognitive deficits. The age difference in the appearance of priming probably suggests that elderly people require more time to encode stimuli and initiate activation through the semantic network.

Reference

Cabeza, R., Grady, C. L., Nyberg, L., McIntosh, A. R., Tulving, E., Kapur, S., et al. (1997). Age-related differences in neural activity during memory encoding and retrieval: A positron emission tomography study. *Journal of Neuroscience, 17*, 391–400.